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(71) Applicants  
Ford Motor Company  
Limited,  
Eagle Way, Brentwood,  
Essex CM13 3BW

(72) Inventor  
D. Stojek

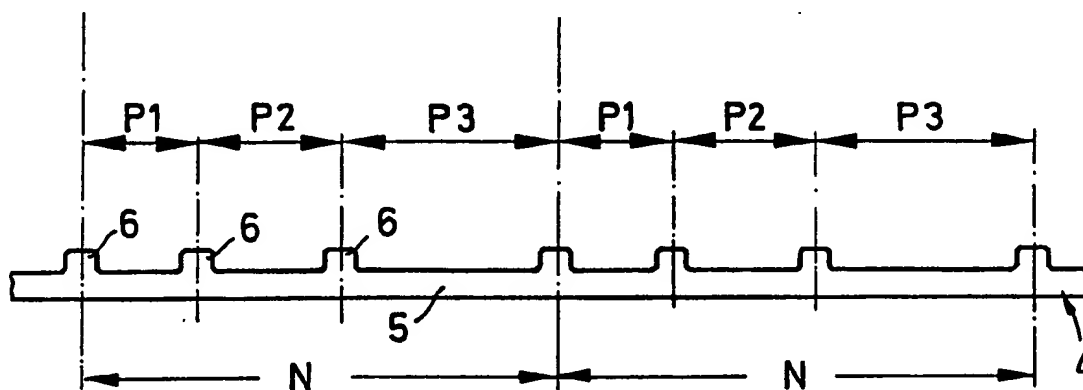
(74) Agents  
A. Messulam and Co.,  
24 Broadway, Leigh on  
Sea, Essex SS9 1BN

(54) **Toothed belt and valve gear for  
an internal combustion engine**

(57) The invention relates to a valve  
gear in which the camshaft is driven

by a toothed belt passing over a  
toothed camshaft pulley. To reduce  
belt noise the invention proposes  
teeth 6 of varying pitch on the belt 5  
and on the pulleys.

FIG.2



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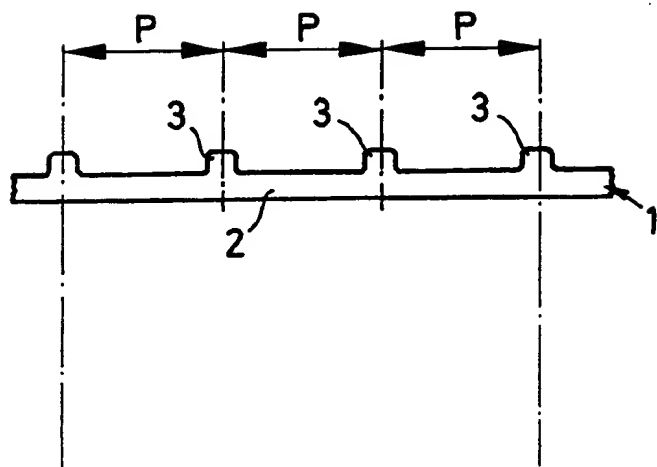


FIG.1

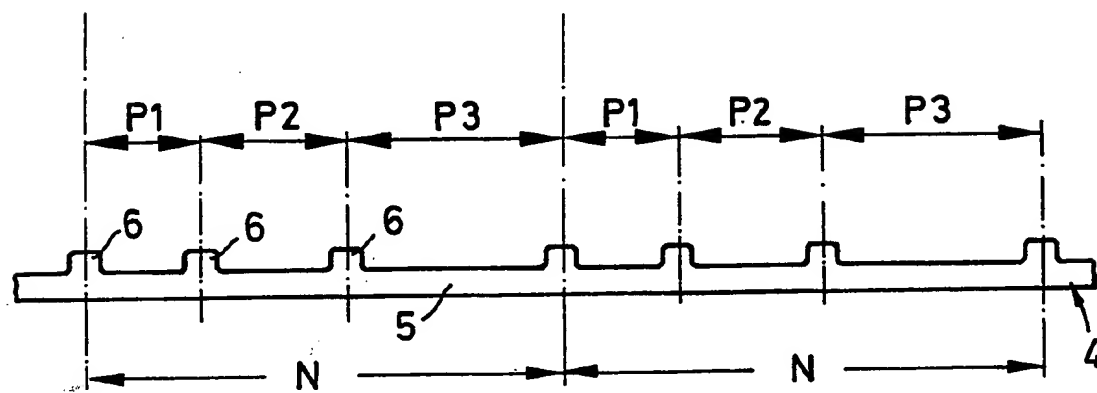


FIG.2

## SPECIFICATION

## Toothed belt and valve gear for an internal combustion engine

The present invention relates to a toothed belt and valve gear for an internal combustion engine.

Almost all toothed belts used for the purpose of driving an overhead camshaft produce noise to a greater or lesser extent. These noises are of various types, ranging from "rattling" through "whispering" to "howling" and almost all are caused by the fact that the straight runs of the toothed belt are caused to vibrate as the teeth on the belt move into and out of engagement with the toothed belt pulleys.

From German Patent No. 2906619 a valve gear is already known, in which to avoid toothed belt noises it is suggested that consecutive teeth be provided with notches of varying arrangement and varying depth in order to avoid resonance.

The present invention relates to an alternative method of reducing toothed belt noises.

According to one aspect of the invention, there is provided a valve gear as herein set forth in Claim 1.

According to a second aspect of the invention, there is provided a toothed belt as set forth in Claim 7.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows schematically a known toothed belt for driving a valve gear, and

Figure 2 is a similar view of a toothed belt according to the invention.

Fig. 1 shows in basic diagrammatic form a toothed belt 1 which consists of an endless tension member having a number of moulded teeth 3. The teeth 3 are at an equal distance from each other which also corresponds to the tooth pitch of the toothed belt pulleys.

Fig. 2 shows a toothed belt 4 according to the invention which consists essentially of an endless tension member 5 and a number of moulded teeth 6 of equal shape. The teeth 6, however, in this case are at differing distances from each other P1, P2, and P3. The distances P1, P2 and P3 are repeated after an interval N which may be designated as the period. Accordingly corresponding gaps must be disposed on the toothed belt pulleys in an integral arrangement of the period N.

The distances P1, P2 and P3 within one period N are related to each other in such a manner that

P1 is smaller than P2 and P2 is smaller than P3.

Alternatively, the distances P1, P2 and P3 may correspond to a random distribution. The ratio of P1 to P2 and to P3 should not be integral. Preferably, the period N can cover a number of teeth 6 which corresponds to a complete toothing (e.g. 20 teeth) of a crankshaft toothed belt pulley. Since the crankshaft toothed belt pulley must always have twice as many teeth, this would then bear two periods N.

Neither the manufacture of toothed belts with such an uneven tooth pitch nor the manufacture of corresponding toothed belt pulleys presents fundamental problems, since on the one hand the toothed belts in their endless form are manufactured in corresponding moulds and on the other hand corresponding toothed belt pulleys can likewise be sintered in moulds, without subsequently requiring any kind of processing of the teeth. Since the manufacture of correspondingly unequal toothed belts and toothed belt pulleys presents no difficulties, it can be seen that in this way toothed belt noises, caused by even vibrations can be avoided by the use of unequal pitch.

## CLAIMS

1. A valve gear for an internal combustion engine in which a toothed belt serves to drive a toothed pulley on the camshaft from a toothed pulley on the crankshaft, in which the teeth on the belt and on the pulleys are unevenly spaced.

2. A valve gear as claimed in Claim 1, in which the spacings between the teeth vary periodically with period N.

3. A valve gear as claimed in Claim 2 in which three predetermined spacings P1, P2 and P3 repeat periodically.

4. A valve gear as claimed in Claim 2, in which  $P1 > P2 > P3$ .

5. A valve gear as claimed in Claim 2 or 3, in which the spacings P1, P2 and P3 are not in an integral ratio to each other.

6. A valve gear as claimed in Claim 1, in which no spacing occurs more than once over the circumference of the toothed crankshaft pulley.

7. A toothed belt for a valve gear of an internal combustion engine having drive teeth unevenly distributed, the sequence of the spacings between adjacent teeth repeating cyclically over the length of the belt.

8. A toothed belt constructed substantially as herein described with reference to and as illustrated in Fig. 2 of the accompanying drawings.

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